COMMUNICATION DEVICE PROVIDING DIVERSE AUDIO SIGNALS TO INDICATE RECEIPT OF A CALL OR MESSAGE

Field of the Invention

[0001] The present invention pertains to communication devices. More particularly, the present invention pertains to a combination telephone and radio providing diverse audio signals to indicate receipt of a call or message.

Background of the Invention

[0002] A telephone to which an incoming call is directed receives an incoming call signal which includes alternating ringing current intervals and silent intervals. By way of example, each ringing current interval might have a duration in the order of about two seconds, and each silent interval might have a duration in the order of about four seconds. During the ringing current intervals, a current at the receiving telephone activates an indicator which provides an indication of an incoming call, for example by causing an audible ringing tone. During the silent intervals, other information might be transmitted to the receiving telephone at a frequency which does not activate the incoming call indicator. United States Patent No. 4,582,956, the disclosure of which is incorporated herein by reference, shows a method and apparatus for providing information at a telephone during the silent interval between ringing current intervals. One type of information that might be transmitted during the silent intervals is caller identification information which indicates the telephone number of the telephone from which the incoming call originated.

[0003] Many, telephones have the ability to respond to the caller identification information by providing an indication of the telephone number of the originating telephone. When the caller identification is indicated in a visual display on the telephone, it is necessary for the person receiving the call to observe that display in

order to determine the identity of the calling number. With a cellular telephone, this might involve removing the telephone from a carrying case in order to view the display. With a land line telephone, it might involve going to the telephone to view the display. Even if the person does not wish to answer incoming calls from certain persons or from unknown persons, still it is necessary for him or her to view the telephone display in order to determine whether the call is from someone with whom he or she wishes to talk.

[0004] Telephones are available in which a listing of preferred calling numbers is stored, and when a call is received from one of those stored numbers, a unique ringing tone is provided. Thus, each of several preferred calling numbers can have its own unique ringing tone. In order to be distinguishable, there must be a reasonable difference between the several unique ringing tones. Only a limited number of ringing tones are available. Users of telephones, particularly cellular telephones like to have unique and surprising indications of an incoming call. Further, such telephones frequently are able to receive short message service ("SMS") messages and multimedia messaging service ("MMS") messages. Users of such telephones like to have unique indications of receipt of those messages.

Summary of the Invention

[0005] To overcome limitations in the prior art described above, and to overcome other limitations, the present invention is directed to a communication device capable of providing users with diverse indications of receipt of a telephone call or of a message.

[0006] In a first aspect, the present invention is a communication device, such as a combination telephone and radio, including a caller identification feature in which a

unique radio frequency can be associated with each of a plurality of preferred calling numbers or message types so that when a call is received from one of the preferred calling numbers or when an SMS or MMS message is received, the radio is tuned to the associated frequency. If a call is received from a calling number other than the preferred calling numbers, for example an unrecognized calling number, the radio can be tuned to a default frequency or, alternatively, a ringing circuit can be activated. As a consequence, the person receiving the telephone call may be able to identify whether the call is from a preferred calling number and may be able to identify the calling number by the particular radio frequency or radio station to which the radio is tuned in response to the incoming call. In addition, the communication device of a preferred embodiment of the present invention can tune the radio to an associated radio station in response to receipt of an SMS message or in response to receipt of an MMS message. Thus, the present invention provides a unique, entertaining, and appealing communication device.

[0007] There are a large number of radio frequencies or radio stations available, including both FM radio stations and AM radio stations. In addition, some radios are able to receive other frequency bands, for example a short wave band or an amateur radio band. Thus, a large number of preferred callers can be accommodated. Responding to the incoming call by turning on a radio station can provide a more pleasant, less disruptive indication of the incoming call.

[0008] In a second aspect, the present invention is a method of indicating the telephone number of the telephone from which an incoming telephone call originated or of indicating receipt of an SMS message or receipt of a MMS message.

[0009] In a third aspect, the present invention is an article in the form of a storage medium having instructions stored thereon, the instructions when executed controlling

a communication device to indicate a telephone number identifying a telephone from which a telephone call originated or to indicate receipt of an SMS message or of an MMS message.

Brief Description of the Drawings

[0010] These and other aspects and advantages of the present invention are more apparent from the following detailed description and claims, particularly when considered in conjunction with the accompanying drawings in which like parts bear like reference numerals. In the drawings:

[0011] Figure 1 is a diagrammatic depiction of a first embodiment of a communication device in accordance with the present invention;

[0012] Figure 2 is a plan view of an embodiment of a communication device in accordance with the present invention;

[0013] Figure 3 is a block diagram of an embodiment of the communication device of Figure 1;

[0014] Figure 4 is another block diagram of an embodiment of the communication device of Figure 1;

[0015] Figure 5 is a block diagram of an embodiment of data receiver suitable for use in the communication device of Figure 4;

[0016] Figure 6 is a block diagram of a controller suitable for use in the data receiver of Figure 5;

[0017] Figure 7 is a flowchart of an embodiment of a method of indicating a telephone number identifying a telephone from which an incoming telephone call originated in accordance with the present invention;

[0018] Figure 8 is a flowchart of an embodiment of a method of operating a communication device in accordance with the present invention;

[0019] Figure 9 is a block diagram of another embodiment of the communication device of Figure 1;

[0020] Figure 10 is a block diagram of an embodiment of a data receiver suitable for use in the communication device of Figure 9;

[0021] Figure 11 is a block diagram of a delay circuit suitable for use in the data receiver of Figure 10;

[0022] Figure 12 is a flowchart of another embodiment of a method of indicating a telephone number identifying a telephone from which an incoming telephone call originated in accordance with the present invention;

[0023] Figure 13 is a diagrammatic depiction of a another embodiment of a communication device in accordance with the present invention; and

[0024] Figure 14 is a diagrammatic depiction of still another embodiment of a communication device in accordance with the present invention.

Detailed Description of Preferred Embodiments

[0025] In the following description of various embodiments of the present invention, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration various embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized, and that structural and functional modifications may be made without departing from the scope of the present invention. In particular, while the following detailed description makes reference to the communication device of the present

invention as a combination telephone and radio, other embodiments of communication devices might also be provided in accordance with the invention.

[0026] Figure 1 depicts a cellular combination telephone and radio 3 which includes an antenna 13 to receive telephone messages and an aerial or antenna 23 to receive radio signals` according to an embodiment of the present invention. If desired, a single antenna may be provided for receipt of both the telephone messages and the radio signals. The cellular telephone has a uniquely assigned telephone number such as 789-555-1234 so that telephone calls placed to that number are received by the telephone section of combination telephone and radio 3.

[0027] Referring to Figure 2 illustrating one embodiment of the device of the present invention, the combination telephone and radio device 3 is at least dual-function in that it provides mobile telephone functionality and broadcast radio receiver functionality. The device 3 includes a microphone 9, a speaker 10, display panel 11 such as a liquid crystal display (LCD), a keypad 12 and an internal antenna element 13. The keypad 12 includes first and second soft keys 12a, 12b, a bi-directional scroll key 12c and a set of alphanumeric keys 12d.

[0028] Referring to Figure 3, the circuitry of the mobile communications device 3, includes a microcontroller 14, and memories such as a RAM/ROM 15 and a flash memory 16. Electrical analog signals are produced by microphone 9 and amplified by an amplifier 17. Similarly, analog audio signals are fed to speaker 10 through an amplifier 18. The microcontroller 14 receives instructions from the keypad 12 and controls operation of the display 11. Information concerning the identity of the user of the mobile communications device 3 is held on a smart card 19, for example in the form of a subscriber identity module (SIM) card for mobile telephones that conforms to the global system for mobile communications (GSM). The SIM card 19 is

removably received in a SIM card holder or reader 20 connected to the microcontroller 14. Microphone 9 and speaker 10 preferably are able to permit operation of combination telephone and radio 3 as a telephone in either a "private" mode, with speaker 10 adjacent the user's ear, or a "speakerphone" mode, with speaker 10 remote from the user's ear, as determined by a manual control (not shown) operated by the user.

[0029] Communication radio signals to and from the mobile telephone network are transmitted and received by means of antenna element 13 connected through an r.f. stage 21 to a coder/decoder (codec) 22 which is configured to process signals under the control of the microcontroller 14. Broadcast radio signals are received by internal aerial 23 connected to a tuner 24. It will be appreciated that a single antenna can be used to feed signals to the both r.f. stage 21 and the tuner 24. It will also be appreciated that the tuner 24 may be integrated into the r.f. stage 21. The device 3 is powered by a rechargeable battery 25 or other power source.

[0030] When the device 3 is used as a mobile telephone handset, the codec 22 receives analog signals from the microphone amplifier 17, digitizes them into a form suitable for transmission and feeds them to the r.f. stage 21 for transmission through the antenna element 13 for transmission to the mobile telephone network. Similarly, signals received from the telephone network are fed through the antenna element 13 to be demodulated by the r.f. stage 21 and fed to codec 22 so as to produce analogue signals which are fed though the amplifier 18 to speaker 10. When the device 3 is used as a radio set, received radio signals are fed through the aerial 23 to the tuner 24 where they are demodulated and fed through the amplifier 18 to speaker 10. Thus, the mobile communications device 3 can be used as a mobile communications handset for voice and data services and as a radio set. These functions are controlled by

microcontroller 14 and can be performed separately or simultaneously. For example, a user can send a text message while listening to the radio.

[0031] The circuitry of Figure 3 relates to the receipt and transmission of messages and radio signals. The circuitry of Figure 4 relates to the receipt of signals indicating an incoming telephone call, SMS message or MMS messages. As seen in Figure 4, combination telephone and radio 3 preferably includes a telephone section 120 which is connected to antenna 13 and a radio section 122 which is connected to aerial 23. As set forth above, telephone section 120 and radio section 122 may be connected to a single antenna, if desired. Telephone section 120 includes a telephone circuit 124 which is connected to antenna 113, and to which are connected microphone 9 and an audio circuit 128. Speaker 10 is connected to audio circuit 128 and to radio section 122. Alternatively, separate speakers can be provided for telephone section 120 and radio section 122. When a telephone call directed to combination telephone and radio 3 is received at antenna 13, telephone circuit 124 causes an indication of that incoming call. While a telephone call is in progress, either a call received by combination telephone and radio 3 or a call originated from combination telephone and radio 3, the outgoing audio signals from microphone 9 are processed by telephone circuit 124 and applied to antenna 13, while the received telephone signals are processed by telephone circuit 124 and applied through audio circuit 128 to speaker 10. Telephone circuit 124 further includes display 11 and keypad 12. Signals resulting from the keypad are transmitted by antenna 13.

[0032] A data receiver 132 is also connected to telephone circuit 124. The output of data receiver 132 is connected to radio section 122. Figure 5 is a block diagram of an embodiment of a data receiver suitable for use as data receiver 132 in telephone section 120. When antenna 13 receives a signal indicating a telephone call for

combination telephone and radio 3, telephone circuit 124 applies an incoming call signal to data receiver 132. Within the data receiver of Figure 5, the incoming call signal is applied to converter 144. Converter 144 determines whether a caller identification signal is present during the silent interval between ringing intervals. If a caller identification signal is present, converter 144 converts the caller identification signal to a serial bit stream indicative of the telephone number of the calling telephone. By way of example, when the caller identification signal is a frequency shift keyed signal, converter 144 might include a frequency shift keyed modem connected to a frequency standard. Converter 144 applies the resulting serial bit stream to controller 148. If no caller identification number is present, converter 144 provides a signal indicating that to controller 148. The output of controller 148 is applied to radio tuner 122a within radio section 122.

[0033] Figure 6 is a block diagram of a processing system suitable for use as controller 148. The signal from converter 144 is applied to a processor 150 which is connected to a program memory 152 and a data memory 154. By way of examples, program memory 152 might be a read only memory, such as an EPROM, while data memory 154 might be a random access memory. Data memory 154 stores a list of preferred telephone numbers, together with associated radio frequencies. In accordance with a program stored in program memory 152, processor 150 determines whether the received caller identification signal is the same as any caller identification signal stored within data memory 154. If so, then processor 150 causes data memory 154 to output the associated frequency signal to radio tuner 122a (Figure 5) within radio section 122, activating the radio tuner at that frequency to provide the audio signals received by way of antenna 13. Data memory 154 also stores a default radio frequency, and if no caller identification signal was detected, or if the caller

identification signal is an unrecognized caller identification signal that is not the same as any stored in data memory 154, then processor 150 causes data memory 154 to output the default radio frequency to radio tuner 122a, activating the tuner at that frequency.

[0034] Figure 7 is a flow chart of the operation of the combination telephone and radio 3 of Figure 1 according to one embodiment of the present invention. In step S1, an incoming call signal is received. Some telephones block the transmission of a caller identification signal to telephones to which calls are made, and so in step S2 it is determined whether a caller identification signal has been received. If so, then in step S3 the calling number is determined. In step S4 it is determined whether the calling number is stored within data memory 154. If so, then in step S5 the associated radio frequency is determined, and in step S6, radio section 122 is tuned to the determined radio frequency.

[0035] If the calling telephone blocked the caller identification signal, then in step S2 no caller identification signal is received, and so the method advances to step S7 in which radio section 122 is tuned to the default radio frequency. Likewise, in step S4 if the calling number is an unrecognized calling number that is not stored within data memory 154, then the method advances to step S7 and the radio section is tuned to the default frequency.

[0036] Figure 8 is a flow chart of the operation of radio section 122 under the control of telephone section 120 according to one embodiment of the present invention. In step S11, telephone section 120 receives an incoming call or message signal. In step S12 controller 148 switches radio section 122 on, and in step S13, controller 148 tunes radio tuner 122a to a particular frequency, either a frequency associated with the identified calling telephone number or the default frequency. In

step S14 controller 148 determines whether a program is being broadcast on the tuned frequency. If not, then in step S15 controller 148 tunes the tuner to another frequency, for example the default frequency. If step S14 determines that a program is being broadcast, then in step S16 the received broadcast is played through speaker 10 to indicate receipt of a telephone call. Once the user of the combination telephone and radio responds to the indication of the incoming call, for example by answering the call, radio section 122 is deactivated in step S17.

[0037] Figure 4 depicts a combination telephone and radio 3 in which every incoming call results in tuning of radio section 122 to a radio frequency, either a radio frequency associated with the calling number or the default radio frequency. Figure 9 is a block diagram of a combination telephone and radio 3a in which incoming calls for which a caller identification signal can not be associated with a telephone number results in activation of a ringing circuit, rather than tuning of the radio to a default station. Combination telephone and radio 3a includes a telephone section 120a which differs from telephone section 120 of Figure 4 by having a ringing circuit 134 with an input connected to data receiver 132a and an output connected to speaker 10 to provide an electronically generated ringing signal to indicate an incoming call. Figure 9 also illustrates that the telephone section and the radio section can utilize the same antenna 13a.

[0038] Figure 10 is a block diagram of an embodiment of a data receiver suitable for use as data receiver 132a in telephone section 120a. Within the data receiver of Figure 10, the incoming call signal is applied to interface unit 140 from which the ringing current is applied to ringing circuit 134 and to delay circuit 142, while any caller identification signal received during the silent intervals is applied to converter 144a. The output of delay circuit 142 passes through OR gate 146 to a disable input

of ringing circuit 134, preventing the ringing signal of the first ringing current interval from activating ringing circuit 134. If no caller identification signal is present, then subsequent ringing current intervals activate ringing circuit 134. Converter 144a converts any caller identification signal to a serial bit stream and applies the serial bit stream to controller 148. The output of controller 148 is applied to radio tuner 122a within radio section 122 and is applied through a second input of OR gate 146 to the disable input of ringing circuit 134, preventing subsequent ringing current intervals from activating the ringing circuit.

[0039] Figure 11 is a block diagram of an embodiment of a delay circuit suitable for use as delay circuit 142 in the data receiver of Figure 10. The ringing current is applied to one input of AND gate 160 and to timer 162. The output of AND gate 160 is applied to the set input of flip flop 164, the 1 output of which provides the delay signal. The 1 output of flip flop 164 is also applied to timer 166. The output of timer 166 is applied to the set input of flip flop 168 and to the reset input of flip flop 164. The output of timer 162 is applied to the reset input of flip flop 168. The 0 output of flip flop 168 is applied to the second input of AND gate 160.

[0040] In the quiescent condition, flip flops 164 and 168 are reset, and so AND gate 160 is enabled. The ringing current then passes through AND gate 160 to set flip flop 164, initiating the delay signal which disables ringing circuit 134. The delay signal also starts timer 166 which, after a time slightly greater then the duration of the first ringing current interval, sets flip flop 168 and resets flip flop 164, ending the delay signal. Absence of the 0 output from flip flop 168 blocks further ringing current signals from passing through AND gate 160. If the calling number has been identified, then the associated frequency signal from controller 148 passes through OR gate 146 (Figure 10) to maintain ringing circuit 134 disabled. That associated

frequency signal also activates radio tuner 122a to provide an audio output of the radio station at the associated frequency. If the calling number has not been identified, ringing circuit 134 is no longer disabled, and so ringing signals during subsequent ringing current intervals activate the ringing circuit.

[0041] The ringing signal during the first ringing current interval also starts timer 162 within the delay circuit of Figure 11. Timer 162 times a time greater than the duration of the ringing current interval and is restarted by the ringing signal of each ringing current interval, thus maintaining flip-flop 168 set and so blocking AND gate 160. Once ringing signals are no longer received, either because the phone has been answered or because the caller has hung up, timer 162 resets flip flop 168, returning the delay circuit to the quiescent condition.

[0042] Figure 12 is a flow chart of the operation of the combination telephone and radio of Figure 9 according to one embodiment of the present invention. In step S21, an incoming call signal is received. In step S22 delay circuit 142 disables ringing circuit 134. In step S23 it is determined whether a caller identification signal has been received. If so, then in step S24 the calling number is determined, and in step S25 it is determined whether the calling number is stored within data memory 154. If so, then in step S26 the associated radio frequency is determined, and in step S27, the radio section 122 is tuned to the associated frequency.

[0043] If the calling telephone blocked the caller identification signal, then in step S23 no caller identification signal is received, and so the method advances to step S28 in which the ringing circuit is enabled. Likewise, in step S25 if the calling number is not stored within data memory 154 and so is unrecognized, then the method advances to step S28 and the ringing circuit is enabled.

[0044] Figure 1 illustrates the present invention in the form of a cellular telephone/radio. Figure 13 depicts the present invention in the form of a combination telephone and radio 3a which has a landline telephone, rather than a cellular telephone. Figure 14 illustrates the present invention in the form of a combination telephone and radio made up of a discrete telephone component 3b and a discrete radio component 3c which are coupled together by the associated frequency output line from controller 148.

[0045] Although various components of the combination telephone and radio of the present invention have been depicted in hardware implementations, preferably the combination telephone and radio is implemented with software on an appropriate processing system.

[0046] The present invention thus provides a communication device which determines whether a calling telephone number is associated with a particular radio frequency, and if so automatically tunes the radio to that frequency and which responds to SMS messages and MMS messages by tuning the radio to an associated frequency. Although the present invention has been described with reference to preferred embodiments, various alterations, rearrangements, and substitutions can be made, and still the result will be within the scope of the invention.